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OHS Indicators and Under-reporting: Case Studies in Chinese Shipping

Conghua Xue^a, Lijun Tang^b David Walters^c,

^a *Department of Humanities and Arts, Nantong Shipping College, Jiangsu, China*

^b *Faculty of Business, Plymouth University, United Kingdom*

^c *Work Environment Research Centre, Cardiff University, United Kingdom*

Abstract

Occupational Health and Safety indicators, such as numbers of indents and near-misses, can be useful tools to manage and improve Occupational Health and Safety. However, under-reporting challenges the validity of these indicators. This article aims to examine the issue of indicator-based reporting through case studies in the Chinese chemical shipping industry. It reveals some economic and social factors which affect crew safety reporting practices and lead to under-reporting as well biased reporting. They include, but not limited to, crew's concerns over their income, future promotion and job insecurity, the face work, solidarity among crew, and the fluidity of employment. As they explicitly or implicitly affect the validity of Occupational Health and Safety indicators, which serves as a reminder for those who adopt indicator-based Occupational Health and Safety management systems. They need to be addressed properly so that the indicators can be used more robustly.

Keywords: Occupational Health and Safety management, Occupational Health and Safety Indicators, case studies, under-reporting, underlying factors

Introduction

System-based approach to Occupational Health and Safety (OHS) management has been increasingly adopted since the 1980s. It can be traced back as early as the 1920s in the Western Electric Company in the United States, and the later risk management systems in the 1960s and 1970s (Bennett and Foster, 2007). It encourages an organisation to go beyond compliance with traditional minimum legal requirements,

and as such is seen as a crucial strategy to deal with workplace hazards and reduce ill health at work (Frick and Wren, 2000). In the shipping industry, the tragic loss of the *Herald of Free Enterprise* in 1987 catalysed the move towards a systematic OHS management strategy (Anderson, 2003). The International Maritime Organisation (IMO) adopted the International Safety Management (ISM) Code in 1994, which came into force in 1998 for passenger vessels, tankers, bulk carriers and high speed crafts over 500 Gross Tonnage (GT), and in 2002 for the rest of the vessels over 500 GT. The main objectives of the ISM Code are to ensure the safe operation of ships, create a safe working environment at sea and reduce the amount of maritime accidents (Anderson, 2003; Oltedal and McArthur, 2011).

In safety-critical industries, such as oil refinery and chemical processing, adoption of OHS indicators, such as numbers of incidents and near-misses, is highly recommended, and it is suggested that managers' incentive schemes should be linked to OHS indicators (Hopkins, 2009). Nevertheless, it is widely acknowledged that such links may result in managing numbers rather than managing safety (Hopkins, 2009; Shaw and Blewett, 2000). In parallel with this argument, under-reporting is a serious issue in OHS management (Azaroff *et al.*, 2002; Probst and Graso, 2013), which undermines the validity of OHS indicators. Similarly in shipping, the ISM code requires seafarers to report safety-related issues to their company, and such reporting has been considered as the most significant indicator of a well-established OHS management system as well as safety culture in a shipping company (Anderson, 2003; Ek and Akselsson, 2005; Lappalainen *et al.* 2011; Lappalainen, 2016; Oltedal and McArthur, 2011). In practice, however, under-reporting is a major noncompliance with the ISM Code (Bhattacharya, 2012; Ek and Akselsson, 2005; Lappalainen *et al.* 2011; Lappalainen, 2016; Oltedal and McArthur, 2011).

While the problem of under-reporting does not necessarily mean that OHS indicators should be abandoned (Hopkins, 2009), it is ascertained that an adequate understanding of the reasons behind under-reporting should be developed in order to manage OHS

and make the indicators more robust. This article aims to examine the issue of indicator-based reporting through case studies in the Chinese shipping industry. The particular focus is on crew reporting practices as an essential part of the OHS management system for a shipping company.

OHS indicator and under-reporting

According to the ISM Code, all shipping companies subject to the Code are required to establish mandated forms of safety management systems. Regardless of the differences between the management systems, it is essential that an OHS management policy should be clearly stated at the beginning of any OHS management system. The word ‘policy’ means ‘the general intentions, approach and objectives – the vision – of an organisation and the criteria and principles upon which it bases its action’ (HSE, 1997:6). It is mainly set up by top management of an organisation, and should reflect the values or beliefs of the organisational members who produce and implement it. An effective OHS management policy sets a clear direction for members to follow. It should not be about ‘lip service’ given by management, but their genuine commitment to action (HSE, 2000). In general, the ultimate goal of an OHS management policy is to maintain specified management standards and achieve expected outcomes.

An OHS management policy is brief, concise and abstract, and it is embodied by actual OHS management objectives. In association with the objectives, OHS indicators are increasingly used in various industries for indicating and measuring whether the objectives are achieved (Buchanan and Huczynski, 1997; Cox and Cox, 1996; Hopkins, 2009; HSE, 2000; Leveson, 2015; Mohammadfam *et al.*, 2017; Shea *et al.*, 2016; Wokutch and VanSandt, 2000). The use of indicators has been seen to be an effective means to manage negative events, as they are easy to measure and can serve as important evidence for rewards and penalties of employee’s performance (Hopkins, 2009; Wokutch and VanSandt, 2000). Based on the indicators, it is easy to establish observable cause-effect relationships between unsafe practices and negative events. The use of indicators for OHS management is also supported by Armstrong and

Armstrong (2008), since it provides valuable data for cross time and cross department comparisons of the effectiveness of OHS management issues and helps shape a better form of work organisation. This practice is potentially able to ‘raise the profile’ of OHS management for an organisation (Wadsworth and Smith, 2009).

However, it is also acknowledged that the sole focus on indicators can be narrow-sighted, inadequate and even problematic due to the complexity of a wide range of OHS issues (Cox and Lippel, 2008; Hopkins, 2000; Shaw and Blewett, 2000). It over-relies on the safety records as indicators of the OHS management, and could lead to reporting biases and discourage workers from reporting safety related issues. Gunningham (2007:12) recognises that a formal system becomes problematic because it could not ‘reveal to what extent near misses and incidents are actually reported, or to what extent or why, workers are constrained from reporting their concerns’. The research by Nichols and Tucker (2000) showed the common use of reported lost time injuries rates and award system raised the concern of creation for incentives not to report injuries. It could lead to the practice that ‘getting the numbers right’ becomes more important than improving OHS outcomes (Hopkins, 2009; Shaw and Blewett, 2000). Research has shown that employees and, in some cases, managers may be unwilling to report OHS issues in order to prevent themselves from being blamed or punished (e.g. losing job, losing bonus, being denied of promotion, and being labelled as trouble makers) (Azaroff *et al.*, 2002; Probst and Graso, 2013).

In this context, some authors like Walters (2005), and Balka and Freilich (2008) expressed a moderate view. While there are obviously ‘positive roles’ in using indicators, some limitations such as ‘underestimation’, ‘reliability of measurement’ and ‘cause-effect’ analysis, and ‘latent conditions’ of incidents are also identified (Reason, 1997:10; Walters, 2005:26). These limitations, including under-reporting, need to be taken into account when incorporating indicators into an OHS management system.

In shipping, one of the key components of the ISM Code and an OHS management

system is reporting safety-related issues such as incidents and near misses to the management of a company. Based on the reporting, OHS indicators are widely used, which serves as the ‘barometer’ of the OHS management. As a result, the reported statistical information can be summarised and measured against the OHS indicators so as to evaluate the outcomes of the OHS management. The rationale is that the shipping company is able to measure the extent to which the OHS management has been achieved. In addition, by collecting and analysing such information, members of the company can learn from the negative events, make more effective accident prevention efforts, and take proactive approach to safety.

To a great extent, the use of OHS indicators depends on the statistics of workplace reporting. Despite the requirements of reporting in the ISM Code, it has been found that while reporting of fatality accidents at sea to relevant maritime authorities was inevitable, less severe accidents and incidents were underreported (Ellis *et al.*, 2010; Hassel *et al.*, 2011, Luo and Shin, 2016; Psarros *et al.*, 2010). The study conducted by Lappalainen *et al.* (2011) showed that incident reporting did not function properly within the Finnish maritime industry. Hassel *et al.* (2011) analysed accident data between 2005 and 2009 from the IHS FairPlay and the maritime authorities of seven flag states and it showed that only about half of the accidents experienced were reported. In general, the literature suggests that underreporting is a ‘considerable problem’ in this industry, and ‘a culture of underreporting’ of safety related occurrences is prevalent (Ellis *et al.*, 2010; IMO, 2008; Oltedal and McArthur, 2011).

Factors affecting underreporting vary. Van Der Schaaf and Kanse (2004) conducted a cross-industrial review and drew out several barriers to reporting on an individual level. They include: (1) fear of disciplinary action or embarrassment; (2) risk acceptance, because incidents are regarded as part of the job; (3) reporting is regarded as useless as reports are not acted on by management; and (4) practical reasons, for example reporting is seen as difficult and time-consuming. The study made by Lappalainen *et al.* (2011) in Finnish maritime industry showed that the maritime personnel have an

occupational culture which is incompatible with the rule-based safety management approach provided by the ISM Code. Oltedal and McArthur (2011) conducted a questionnaire survey on Norwegian merchant fleet and Kongsvik *et al.* (2012) conducted a similar study on offshore service vessels operating on the Norwegian continental shelf. While they drew on Van Der Schaaf and Kanse's (2004) findings, both studies extended to organisational factors that affect safety reporting practices. These factors include safety training and crew competence, safety management, general safety practice, feedback on reporting, and perceived demand for efficiency.

While Oltedal and McArthur (2011) and Kongsvik *et al.* (2012) touched upon fear of blame, they did not explore what underpinned such fear. Bhattacharya (2011) took a qualitative approach and shifted the focus onto how employment relations discouraged seafarers from reporting. His study showed that it was primarily the fear of losing job that resulted in under-reporting. This fear was caused by the structure and employment practice of the industry which was characterised by short-term contract. Shipping is a globalized industry as the common practice of flagging out enables ship owners/managers to register their ships in Flag of Convenience (FOC) countries (such as Liberia and Panama) and allows them to employ seafarers from any labour supply countries through local crewing agencies (Alderton *et al.*, 2004). As ship-owners take full advantage of the global seafarer market, the practice of permanent employment of seafarers has become less common and more and more seafarers are being employed from new labour-supply nations on short-term contractual employment (Alderton *et al.*, 2004). The short-term contracts are found to discourage reporting (Kongsvik *et al.*, 2012).

Such employment relations give rise to strong power inequalities between managers and seafarers, which can have a negative impact on the development of trust (Cook *et al.*, 2005; Oskarsson *et al.*, 2009). Even though shipping companies claimed to have a non-blame culture in place, seafarers had no faith in it as the lack of long term employment made seafarers vulnerable to managers' power (Bhattacharya, 2011 and

2012). Without trust, workers would not communicate with their managers freely and openly and honest reporting would not be achieved (O'Reilly, 1978).

While Bhattacharya's (2011 and 2012) detailed exploration of fear of blame goes beyond individual and organisational barriers and extends to the structure of the industry and the associated power inequality, it nevertheless focuses mainly on the power of managers to terminate seafarers' employment. Arguably, this is one end of the full spectrum of the ways in which managers can exert power. Manpower shortage has been a long standing issue in the industry and recruitment and retention of qualified seafarers is a big concern of ship managers. Consequently 'poaching' of seafarers is not uncommon in the industry (Leong, 2012). In this context, threatening of terminating employment is unlikely to be common strategy that managers would use to discipline seafarers.

As mentioned in the introduction, the article will examine indicator-based reporting practices in Chinese shipping. Considering the research on fear, power and OHS reporting in the maritime industry, this article contributes to this literature with a close examination of crew reporting practices in the Chinese context. It seeks to better understand crew reporting by exploring a broad range of factors that contribute to under-reporting, which is supposed to be properly addressed by shipping companies as well as international shipping industry.

The cases and research methods

The research consisted of case studies of two Chinese Chemical shipping companies. Both companies are located in the Yangtze delta area in China. Company 1 (C1) is dedicated to oil and chemical transportation. It was established in 1994 by its Group Company. By 2017, the company had 16 special cargo carriers, among which 11 were chemical tankers. C1 had its OHS management system since its establishment. The system was named as 'Quality, Safety and Environment Management System' (QSEMS) in line with the ISM Code, NSM (National Safety Management) Code, ISO

9001:2000 and ISO14001:2004. In addition, the system considered the standards from OHSAS18001 (Occupational Health and Safety Assessment Series), TMSA (Tanker Management and Self-Assessment Guide) and VIQ (Vessel Inspection Questionnaire). The QSEMS is regarded as a ‘statutory document’ in which the company’s OHS management policy, corresponding objectives and management commitment are clearly stated. In order to quantify and measure the achievements of its safety policy, the company accordingly laid down detailed objectives. In line with each of these objectives, there was an affirmative statement or numerical value attached for the purpose of measurement and assessment (See Table 1).

Table 1. The objectives of OHS management (C1)

Safety Objective	No significant accidents, aiming at zero accidents and zero pollution
Health Objective	Rate of casualty is zero; work-related injury ≤ 1
Inspection Outcome Objective	Rate of ship detention by PSC ¹ : zero; rate of passing oil majors inspection: 90%
Ultimate Objective	To achieve zero accidents, zero pollution through thorough implementation of the OHS management system

Company 2 (C2) was established in 2004. It operated 19 chemical tankers in 2017. The company’s management system was named as Quality and Safety Management System (QSMS). The company has passed the ISM as well as NSM verification. Similar to C1, this company broke down its general policy statement into quantified annual objectives. The objectives, illustrated in Table 2, are extensions to the original statement.

Table 2. The objectives of OHS management (C2)

Health Index	Personal casualty rate: LTIF ² ≤ 2.0 ; TRCF ³ ≤ 4.0
Safe Operation Index	Average Loss: no occurrence of average level accidents;

¹ Port State Control

² Lost Time Injury Frequency

³ Total Recordable Case Frequency

	minor incidents $\leq 2/\text{Annum}$ Machine Damage: no occurrence of average level accidents; minor incidents $\leq 2/\text{Annum}$
Environmental Protection Index	No occurrence of average level pollution accidents; minor incidents $\leq 2/\text{Annum}$
Safety Inspection Index	PSC/FSC ⁴ detention rate: zero; industrial inspection pass rate: $\geq 90\%$

In C1, the crewing company of the Group Company was in charge of crew's arrangement. The majority of crew signed long-term contracts with the company. The average working period onboard was between 6 and 9 months. In C2, the crew department was in charge of crew recruitment from the domestic seafaring labour market. Most of the crew signed short-term contracts with the company, and only 15 percent of them had long-servicing contracts (usually 3 or 5 years). Both companies' fleets were mainly registered in China. The major trading areas for both companies were in the western Asia Pacific region, and a few large ships were operated globally. Both companies adopted an index-based approach to OHS management and the objectives of the management have been quantified accordingly. They were referred to by the management at regular intervals and further compared with actually reported cases in order to measure the quality of their OHS management.

In line with the common practice of case studies (Yin, 2009), this research took a qualitative approach in order to achieve an in-depth understanding of the issue. The field work included one researcher's visits to two companies' offices and sailing with four of their chemical tankers (two tankers from each company) for four short voyages. The study mainly used semi-structure interview technique. In total, 55 interviews with crew were conducted in Chinese during the research voyages. Afterwards, they were all translated and transcribed into English for the convenience of data analysis. The field work also included observation of crew's daily work activities, informal chatting with

⁴ Flag State Control

them in various occasions and analysis of collected documents in relation to this study. The ethical approval for conducting the research was granted by Cardiff University. As various sources of data were converged, initial analysis of them was carried out and key concepts were highlighted in the text. Then, the Nvivo software was applied to assist data coding and in-depth analysis. As a result, some of the common themes in relation to this study were identified. In general, the results showed a significant gap between what is required and what really occurs in terms of crew safety reporting, which is presented in the following.

Similar understanding, inconsistent behaviours

The safety management policy and objectives were required to be posted on public areas onboard ships of both companies. The crew members onboard the four ships demonstrated a clear understanding of safety reporting policy. Also, they were aware of the general principle of reporting practice, i.e., ‘seeking truth from the fact’. According to the requirements of the management systems of both companies, crew safety reporting covered a wide range of OHS management activities. Each of the crew members onboard a ship was obliged to report safety-related events to the shore management no matter how minor they were – even if they were ‘pins’ or ‘wires’ for fixing or lashing a lifeboat, as long as they had implications for improving shipboard work safety. For example, a junior engineer said:

According to the requirement (of the management system), even a tiny problem should be reported. Even if it had occurred today, and would be repaired tomorrow, it should also be written and reported.

In general, the importance of making such reports was acknowledged by the crew members during the interviews. The following statement is given by another junior engineer:

The report must be made. Self-inspection reports must be made regularly. If you don't have any deficiencies to report, is it realistic?

Self-inspection was one of the major OHS management activities onboard a ship. The inspection result should be reported to the shore management at regular intervals. The

crew understood that, more or less, there were certain safety-related problems onboard a ship. In a few cases, it might be that there were no deficiencies to be identified, but that did not mean that the ship was perfect:

If you cannot find out the problems yourselves, it doesn't mean you are 100 percent perfect. If you dared to claim so, the shore management would come to assess and inspect ... to see whether you actually were 100 percent safe. (A Bosun)

Thus a lack of any report of safety issues was construed as crew's failure to identify safety-related problems, which further pointed to their incompetence regarding onboard safety management.

While the need for safety reporting was understood by the crew members, in practice, it was found that they behaved in a different way and as a matter of fact, OHS-related problems were not fully reported. The interviews with the crew members showed that a significant number of them showed a relatively conservative attitude – only few of them were willing to participate in voluntary reporting. For the lower ranking crew, they showed a significant disinterest in reporting. They thought it was unnecessary to make such reports:

The reporting is done by the captain. Whether he reports to the shore management, it's up to him. The lower ranking crew would not make a report. It's unnecessary to talk about this. It is nothing to do with my job. (A Motorman)

This motorman thought the reporting was done mainly by senior officers and so it was irrelevant to his work. Another rating also showed an indifferent attitude towards reporting near misses:

The near miss ... It didn't have any real consequences. We feel it has passed and there is no need to report it. What is it for?

The research by Bailey *et al.* (2007) identified different levels of risk perception in the maritime industry, and lower ranking crew also showed a lower level of risk perception. Regarding the officers, they were supposed to be more active and were obliged to submit reports. The data, however, suggested that voluntary reporting was also rare

among them in both companies. A captain described the gap between what the shore management expected and what the crew actually thought:

It is very likely they will not submit a report. They (shore management) are leaders and they want to know everything about us: Don't hide anything. But it is difficult to do as they wish.

As mentioned above, a lack of safety related reports was not acceptable, however, as a practical solution, some crew members commented that the reporting could be done in an alternative way. For example, a chief officer said:

We had certain considerations. The ship could not report all the issues to the shore management. Also, the ship could not report nothing. (As a solution), some innocuous cases can be reported.

The interview data indicated that innocuous cases referred to issues of less significance to the OHS management. One second officer explained:

Sometimes, if it is hard to find anything, I just randomly write something unimportant, for example, I find something that is going to expire.

Unsurprisingly crew members, particularly senior officers, would take 'deliberate considerations' prior to making reports to the shore management. One captain talked about the 'principle' that guided his reporting:

Basically for us, the principle of reporting is to report only the good and not the bad, to avoid critical points and to dwell on the trivial.

Protecting self, protecting others

It emerges the question why the crew members behaved the way they did. A simple explanation is that safety reporting was significantly affected by crew's concern of their self-interest. Firstly, the interviews suggested that the reporting could affect management's impression on crew's performance. If many nonconformity cases were reported by a ship, the management might think that the ship's leaders were not good:

If you reported many, the shore management would have second thoughts. They would think that your ship had safety problems and the ship's leaders were no good enough. (A Second Engineer)

From the crew's perspective, the reporting could imply that their safety management onboard had problems, and accordingly, they could leave negative impression on the

shore management. Thus, crew members were sensitive about the reporting.

The research further found that safety reporting could affect crew's income. In C1, it was called 'performance pay', while in C2, it was called 'safety bonus'. The reported items would be assessed by the shore management as evidence for determining payment. One captain mentioned that there were often deductions from his salary by his company:

Now it is tricky. If a problem was reported, my money would be deducted. Personally, my salary was often docked by the company.

The quote showed that the reporting was closely related to crew's income, which is likely to affect crew's willingness to making reports. Apart from this, it was found that the reporting could affect their prospects of promotion. In order to be able to be promoted to a higher position, a crew member's certificate upgrading exam needed be arranged by their company. This is particularly the case in C1 with which most of them had long-term contracts. The arrangement would prioritise those whose performance was assessed as good by the shore management. The reported cases were a key indicator of a crew member's performance. For example, a second officer said:

If your work was not done well and reported, this would affect the company's consideration for the arrangement of your license upgrading exam ... affect your promotion. They are all relevant.

More directly, the impact of a crew member's job arrangement was also significant. For instance, a chief engineer gave the following reason:

If a senior officer does not perform well, it is impossible for him to be promoted to captain or chief engineer. A superintendent can decide that a person cannot be a captain on the ship supervised by him. He has this power, since it involves shared responsibilities.

The implication is that a superintendent had the decisive power over the appointment of a crew member, particularly a senior officer. This means that even if a chief officer gained a captain's qualification, he might not be able to be appointed to a ship as a captain supervised by a superintendent who disliked that person or distrusted his capability.

As soon as a case report, particularly a near miss, was received by the shore management, it would be assessed by the managers in both companies. If the result of the investigation was judged as valuable for improving a ship's safety, it would be circulated among the company's fleet. Although this was done in an anonymous way, the person who caused it could be easily identified by his fellow colleagues. For example, a second engineer expressed his worry about the potential impact on his personal reputation:

Even though the person's name is not mentioned, other colleagues could know by guessing, since they would know who the second engineer is on that ship. It causes a bad impression on the person.

The importance of 'face' at work for Chinese people has been highlighted in the literature. It is seen as a salient feature in the Chinese culture (Fang, 1999; Lu, 1991). Typically, in a particular group or unit, the positive sides are encouraged to be exposed to outsiders while the negative sides should not be brought to the public. In a similar vein, this case means that the loss of face would be known to his colleagues, which prevented crew's willingness from reporting.

Apart from the above-mentioned points, the study further revealed a strong presence of solidarity onboard ships, which meant that the crew on the same ship tended to protect each other. Therefore, senior officers would think twice whether to report certain cases or not when such cases would implicate their colleagues. For example, a chief engineer expressed his concern regarding younger crew members:

The young men ... they are very good usually. One might show dangerous behaviour due to carelessness. I met this situation on this ship. Should I kick him out? Then how should I deal with it? Try my best to remedy the situation, rather than something else (reporting).

This description showed a strong sense of solidarity among Chinese crew members. As they worked together on the same ship for a prolonged period of time, the crew believed that harmonious relationships were in everybody's interest and the reporting could result in tensions which were not good for safety either.

In addition, one of the major concerns for the shore management was the need to pass external inspections. The self-reported deficiencies would be easily observed by an external inspector, which could lead to further enquiry into the deficiencies. In this case, not only would the relevant crew members' interests be affected, but also the ship might be ordered to make remedial actions, or even be detained, in which case ship's sailing schedules as well as company's business reputations would equally be affected. Also, it could possibly annoy management and further lead to investigatory and disciplinary actions against relevant crew. Under such a circumstance, a senior engineer felt he was placed in a dilemma about whether a problem should be reported:

If a problem was reported, you knew it was wrong and you didn't solve it ... not only would the crew be in trouble, but also the company would be in trouble. It was very easy to be identified by inspectors.

Thus, it could be seen that the recorded deficiencies could affect an inspector's judgement of a ship's OHS management status. For the purpose of protecting crew themselves as well as their companies, some cases were intentionally excluded from the reports.

As a consequence and in order to avoid troubles, a crew's pre-communication with shore management was usually seen to be an initial step before a formal written deficiency report was sent. The reporting would be 'advised' by the manager or superintendent responsible for that ship regarding what and how to report. For example, a chief officer described the issue as follows:

Sometimes, the superintendent hopes you (crew) to report by telephone; sometimes, they hope you to report by written (report). If you (communicate) through a written report directly, it's very formal. This might not help us. So we would make a telephone call to him to report in advance in order not to annoy him.

Compulsory reporting, limited role

In parallel with reporting safety-related problems, reporting near misses received equal emphasis, since a near miss case could have the same underlying causes as an accident. In C1, the report was requested as soon as a near miss was identified onboard; while in

C2, there was a compulsory requirement that at least two near misses be reported every month. Meanwhile, the management systems of the two companies specified that the reported cases should not be repetitions of those that had been reported previously from any of the ships. The reason was that all ships had been informed of those cases, and the repeated reporting meant a lack of care regarding the company's notifications, which equally meant the lack of sense of responsibility. For instance, a chief officer said:

All the near misses that have been reported previously should not be repeated. If it has occurred once and it occurs a second time, then it proves that your (ship's) management was not good.

The reoccurrence of a particular case could signify a vulnerability that was more likely to cause an incident or accident. Discouraging the report of such cases could result in the company missing out on valuable statistical data. As a result of the discouragement, a captain commented that they faced a dilemma:

Generally, the number of reportable near misses was reduced. We have almost finished reporting whatever we are able to think of, because we should not repeat the mistakes we have made previously.

In order to deal with this dilemma, the crew members described their strategies, among which the following one was typical:

We have to submit a report even if there are no such cases. What should we report if there are no such cases? (As a result), the only way is to imagine something... (A Chief Officer)

In general, the response of the crew members on two ships in C2 showed that they did not take this requirement seriously in their work practice. During the field trips onboard ships, some near misses were observed and noted down in the field notes:

It was a fine day sailing at sea. I participated in crew's tank washing work. I saw deck ratings wearing only common yarn gloves. The washing required crew members to go down to the bottom of the tanks, which were more than 10 meters high, but none of them wore any protective apparatus on their heads and faces. I could feel the pesticide-like smell from time to time...

However, these safety issues, occurred in crew's day-to-day operations, were not reported to the shore management. Rather, 'self-digestion' was referred to by some crew

members in dealing with safety-related problems onboard ships, which meant that they might not report a problem until a significant consequence occurred. For example, a chief officer said:

It was rare (to report). If you reported (it) to the shore management, it would cause trouble. Usually, it would be digested onboard unless it caused serious consequences.

Under such circumstances, 'self-digestion' of the problems only meant that crew were aware of them and managed to deal with them on their own. It never meant an appropriate solution to the problems in the absence of substantial management support. As a consequence, some of them remained unsolved and could pose significant threats to crew's OHS as well as their working conditions.

Fluid service, less caring

It is a common practice in shipping that ships are operated by fluid crew members, which means that they are not fixed to any particular ships but serve different ones for their next contracts. Such fluidity also weakens their willingness to report incidents. As stated previously, in C2, the majority of the crew members were employed on short-term contracts. They seemed reluctant to report incidents. For example, one senior bosun reflected on his thirty years of seafaring experience and said:

I met many occasions of near misses. In general I would not report. We are the freelance seafarers. I worked in this company today, but I would leave it some day. Why should I care about it? It would not be reported until there is an accident.

In C1, although the crew members were likely to be employed on long-term contracts, they might not return to the same ships after their shore leaves. This also made crew members in C2 unwillingness to report incidents. For example, a third officer from C1 said:

If you were only onboard for a few months, you reported this and that, wanting to change everything, and then you were going to leave...many people don't want to do like that. Next time, I might change to another ship. I would not go to this ship again.

Therefore, although the crew members in both companies had differing contractual terms and conditions, there was no significant difference between them in terms of the practice of safety reporting. In general, the nature of fluidity of crew's employment affected crews' motivation to make safety-related reports.

Concluding discussions

It has been argued that OHS indicators can be useful tools to manage and improve OHS as they are not only easy to measure but also provide valuable data for cross time and cross department comparisons (Armstrong and Armstrong, 2008; Hopkins, 2009; Wokutch and VanSandt, 2000). Employee reporting is located at the heart of any OHS management system based on indicators. However, under-reporting poses a challenge to the validity and usefulness of such indicators (Azaroff *et al.*, 2002; Hopkins, 2009; Nichols and Tucker, 2000; Shaw and Blewett, 2000). In this context, it is necessary to develop a good understanding of the role of OHS indicators in signifying the quality of OHS management and the reasons behind under-reporting so that strategies or policies could be designed to better contain the problem and to make the use of indicators more robust.

Building on the previous research on why crew members do not to report (Bhattacharya, 2012; Kongsvik *et al.*, 2012; Lappalainen *et al.* 2011; Oltedal and McArthur, 2011; Van Der Schaaf and Kanse, 2004), this study reveals a number of economic and social factors to explain why they were reluctant to report. In line with the outcome of previous research both in the shipping industry and some other safety-critical industries (e.g. Azaroff *et al.* 2002; Bhattacharya, 2011 and 2012; Bhattacharya and Tang, 2013; Nichols and Tucker, 2000; Probst and Graso, 2013), the study indicates that one of the major factors was the concern of their self-interest which included their income, future promotion, job insecurity, etc. As a breadwinner of a family, an employee's economic condition may override their concern for OHS in the view that maintaining family income is crucial for survival (Levenstein and Tuminaro, 1997).

To a great extent, the crew's concern of their self-interest was mainly originated from the management's dominant power over crew's performance evaluation, as was shown in the data. It was pointed out that the division of labour in an organisation leads to power differences between management and employees (Pfeffer, 1992). In a shipping company, the shore management, situated at a higher hierarchical level, is entitled to exert dominant power over the shipboard OHS management practice and crew's employment. In both companies, the managers had decisive power on appraisal of crew's performance as well as appointment of individual crew, particularly those of senior ones. In this context, being evaluated by them as a good performer was very important for individual crew, since it closely linked to crew's job prospect and security. Situated in such power relations, crew also tended to protect themselves and their colleagues and tried not to offend managers. In general, this perception of the presence of management's dominant power over ship management and crew performance could not be helpful for facilitating crew safety reporting that was conducive to the improvement of workplace OHS management.

As a complement to the previous research, this article also revealed a few social factors. The study showed that the face work, solidarity among crew, and the fluidity of crew's employment, all contributed to under-reporting. The first two may be more salient in Chinese culture (Fang, 1999; Lu, 1991). However, they are unlikely to be exclusive to Chinese culture, saving or losing face and solidarity are concepts also known in English (Bhattacharya, 2012; Rossignol, 2015). In addition, fluidity of employment is certainly a common practice in the shipping industry. Therefore, these findings are helpful for those who employ crews and operate ships globally.

The economic and social factors identified in this study contributed to under-reporting as well as biased reporting. Given the mandatory requirements of safety reporting, in particular the near missing reporting, it could not make any noticeable improvement, and crew reporting practice remained unchanged. Thus the shore management's evaluation of the paper logs reported by crews was of limited value for OHS

management onboard ships. Accordingly, crew safety reporting practice revealed the limited role of OHS indicators which could be played in indexing the value of OHS management.

Both under-reporting and biased reporting threaten the validity of OHS indicators. From the perspective of shipping companies, if they are serious about using OHS indicators as a tool to manage and improve safety, they should be aware of the underlying influential factors that affect crew safety reporting, and address them properly. From the perspective of academic as well as industrial researchers who use OHS indicators to evaluate the outcome of OHS management of shipping companies or the shipping industry, they may need to exercise caution in interpreting such data.

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